UNCLASSIFIED/UNLIMITED Copy of Book

[redacted]

S ES Index

COPY NO....
CLASS II

p-1A

This Report is Informal and the Conclusions are only Tentative

SUFFIELD FIELD REPORT NO. 133
(9 Aug. 1945)

The Physiological Effects of Mustard Vapour at Low Temperatures

REFERENCE

Field Experiment 215 carried out 28 March, 8 December 1944, 18 January, 25 January and 3 April 1945 (trials 1 to 5)

INTRODUCTION

1. This report deals with the results of five chamber trials which have been carried out to examine the physiological effect of various dosages of mustard vapour at air temperatures of approximately 0°C (32°F).

PROCEDURE

2. In each trial ten observers dressed as follows:

Shorts impregnated (trials 1 to 4 only)
Underwear (long limbed)
Shirts K.D.
Sweater coats (long sleeves)
Battle dress
Boots and socks
Gloves A/G
Impregnated hoods (trials 2 to 4 only)
Respirator at the gas position
Drill order,

were exposed in an unheated hut for a period of 45 minutes to one hour to mustard vapour put up by the evaporation of mustard gas from a hot plate.

3. The air in the hut was mixed by means of fans. During the period of occupation vapour samples were taken by means of injector operated bubblers at heights of 21 and 60 inches at various positions in the hut. The samples were analysed by the iodoplatinate method. The air temperature and relative humidity inside the hut was also recorded.

4. Some or all of the observers in each trial were exercised during their exposure. In trial 1 all observers carried ammunition boxes round the hut at intervals of five minutes. In trials 2 to 4 all observers walked round the hut during their exposure. In trial 5, five of the observers walked round the hut during their exposure. The remaining five, except for changing their positions every ten minutes, sat on chairs. While changing their positions each observer walked once round the hut.

5. After their exposure the observers continued to wear their clothing for a further hour (2 hours in trials 1 and 5) during which time they occupied a warm room (air temperature approximately 70°F). * In trials 4 and 5 the observers continued to wear their respirators during this period. * The observers in trials 2 to 5 inclusive were out of doors for a few minutes while transferring to the warm room, 300 yards from the exposure chamber.

RESULTS

6. The air temperatures and relative humidities recorded inside the hut during the five trials are given in Table I.

Classification / Designation
Changed to / Remplacée par ___u/u___
By Authority of
Sur l'Autorisation de ___ C.Laforce ___
NRC 100 ... D.V.Soler

49/7483 +1

TABLE I

Trial	1	2	3	4	5
Air Temperature (°C)	0° to 4° (32° to 40°F)	2°to 5° (36° to 42°F)	-0.5° to 0.5° (31° to 33°F)	0° to 1.5° (32° to 35°F)	2° to 7° (36° to 44°F
Relative Humidity (%)	40 to 45	52 to 60	60 to 74	60 to 69	54

7. The dosages recorded in the five trials are given in Table II.

TABLE II

Trial	Exposure time	No. of Sampling points	Dosage of H vapour (mg.min/cu.m.) at height of: 21" max:	21" min:	21" average	60" max:	60" min;	60" average
1	1 hour	7	514	358	422	406	261	325
2	45 mins.	4	555	445	493	365	363	364 (2 points only
3	1 hour	4	515	392	449	435	315	382
4	1 hour	4	895	843	873	695	567	640
5	1 hour	4	1350	1290	1330	1180	890	1030

8. The lesions produced in the five trials are given in the Appendix. In trial 3, three of the observers developed mild conjunctivitis presumably caused by vapour desorbed from their clothing during their one hour occupation of the warm room. Nine of the 10 observers in trial 5 also developed mild conjunctivitis. They had worn their respirators for all except 10 minutes of the two hours they spent in the warm room.

DISCUSSION

9. In trials 1 to 4 all observers exercised during their exposure. In trial 5 half of the observers exercised and the remainder were at rest. Comparison of the lesions produced in the two groups in this last trial shows that the group which exercised sustained slightly more severe lesions on the limb and trunk and markedly more severe lesions in the genital region.

10. Lesions of casualty severity were not produced in trials 1 to 4. This is also true of trial 5 if lesions of the genital region are excluded.

11. Observers who were at rest during their exposure in trial 5 were considered to be partially disabled (observers 7 to 10) or injured without disability (observer 6) as a result of their genital lesions. Observers who exercised during their exposure were considered to be totally disabled by their genital lesions.

CONCLUSIONS

12. Partial disablement due to genital lesions has been produced amongst men, dressed as in these trials, by exposing them at rest to a dosage of mustard vapour of approximately 1200 mg.min/cu.m. in a chamber in which the air temperature was 2° to 7°C (36° to 44°F) and the relative humidity 54 percent.

13. Under the same conditions genital lesions which were considered sufficiently serious to cause total disablement have been produced amongst men who exercised during the exposure.

14. In neither case were lesions of casualty severity produced on the remainder of the body.

HJF: jm

H. J. Fish
(H.J. Fish)
P.R.S.,
Experimental Station,
Suffield, Alberta.

APPENDIX (cont'd)

OBSERVER RESULTS - MAXIMUM EFFECTS PRODUCED AND TIME OF DEVELOPMENT

(In trial 5, observers 1 to 5 exercised during their exposure)

Part of body	Trial No. / Observer No.	1	2	3	4	5	6	7	8	9	10
Trunk	1	E⁻ of neck front and back extending down to level of shoulder blades posteriorly and below clavicles anteriorly 3 - 4 days	E of neck E front of chest to nipple line 3 days	E⁻ back of neck 3 days	E of neck delimited by respirator 3 days	---	E of neck 4 days	Pigmentation of neck 4 days	Pigmentation of neck 4 days	E of neck 3 days	E of neck 3 days
	2	---	---	---	---	---	---	---	---	---	---
	3	E of upper back 3 days	E⁻ of back 4 days	E⁻ of upper back 3 days	---	---	---	---	---	---	---
	4	E⁻ of entire back to waistline including both sides of trunk 3 days	---	---	E⁻ of back scapula to belt line 2 days	E of entire trunk 4 days	---	E⁻ of entire back including both sides of trunk 4 days	E⁻ of back & right side of trunk	E of back 2 days	E⁻ of back
	5	E of back (2 - 4 days) E of buttocks with E⁺ and ppv of natal cleft. (8 - 12 days)	E⁻ of back 1 day	E of back dry desquamation (4 - 8days) E of buttocks (2 - 4days)	E of back and buttocks 2 - 4 days	E⁻ of back & buttocks 2-4 days	E⁻ to E of upper back 3 days	E⁻ to E of back (1-4 days) E⁺ of top of natal cleft with moist desquamation (2-8 days)	E⁺ of back E of buttocks 1-4 days	E to E⁺ of back with dry desquamation. (2-5 days) E of buttocks (1-4 days)	E⁻ of back 2 days

APPENDIX (cont'd)

OBSERVER RESULTS - MAXIMUM EFFECTS PRODUCED AND TIME OF DEVELOPMENT
(In trial 5, observers 1 to 5 exercised during their exposure)

Part of body	Observer No. / Trial No.	1	2	3	4	5	6	7	8	9	10
Legs	1	E at bend of left knee 3 - 4 days	E of legs 3 days	---	E⁻ of bends of knees 3 days	E⁺ of legs on medial aspect 7 days	---	---	---	E of bends of knees 3 days	E⁻ of bends of knees 3 days
	2	---	---	E of backs of knees 3 days	E⁻ of back of left knee 3 days	---	---	---	---	---	---
	3	---	E⁻ bends of knees 4 days	---	---	---	---	---	---	---	---
	4	---	---	---	---	E⁻ of knees 4 days	---	E⁻ of bends of knees 4 days	E⁻ of legs 4 days	E of bends of knees 2 days	E⁻ bends of knees 2 days
	5	E⁻ of bends of knees 2 - 4 days	E⁻ of bends of knees 2 - 4 days	E of backs of knees 2 - 6 days	---	E⁻ of bends of knees with dry desquamation 3 to 5 days	E⁻ bends of knees 1 - 2 days	---	---	E bends of knees 1 - 4 days	---

APPENDIX

OBSERVER RESULTS- MAXIMUM EFFECTS PRODUCED AND TIME OF DEVELOPMENT

(In trial 5, observers 1 to 5 exercised during their exposure)

Part of body	Trial No. / Observer No.	1	2	3	4	5	6	7	8	9	10
Arms	1	E of Armpits 3 - 4 days	E of bends of elbows 3 days	---	E⁻ of bends of elbows 3 days	---	E around armpits; E⁻ of bends of elbows 4 days	Pigmentation of armpits and elbows 4 days	---	E⁻ bends of elbows 3 days	E⁻ bends of elbows 3 days
	2	---	---	E⁻ of armpits 3 days	---	E⁻ of left armpit 3 days	E of armpits 3 days	---	---	---	---
	3	E of armpits; E⁻ of backs of elbows 3 days	E of armpits 4 days	E of right armpit 3 days	-----	---	---	E⁻ of front of elbows 4 days	E⁻ of front of elbows 4 days	E of front of elbows 3 days	E⁻ of bends of elbows E of right armpit 3 days
	4	E⁻ right armpit 3 days	E of armpits 3 days	E⁻ of armpits; E⁻ of bends of elbows 2 days	E bends of elbows; E⁻ around armpits 2 days	E of both arms; E⁺ of bends of arms 4 days	---	E⁻ to E of bends of elbow 4 days	E⁻ bends of elbows E⁻ to E of armpits 4 days	E of bends of elbows and fronts of armpits 2 days	E bends of elbows 2 days.
	5	---	E⁺ of arms more marked at bends of elbows with fissuring of skin 6 to 10 days	E to E⁺ of arms more marked at flexor creases. These areas desquamated and fissured 6 - 12 days	---	---	---	---	E front of arms with E⁺ at bends of elbows 1 - 4 days	E⁻ of upper arms 1 - 3 days	E of bends of elbows 2 days

APPENDIX (Cont'd)

Part of body - genitals

Trials 1 to 4 — No effects were produced in trials 1 to 4 since impregnated shorts were worn

Trial 5

Observer	Time of examination (days after exposure)			
	1	2	3	5
1	E^+ of penis and scrotum edema most marked at prepuce. E of groins and inner aspect of thighs.	No change	Oozing of dependent parts of scrotum, edema subsiding.	Penis and scrotum improving except for massive edema of prepuce.
2.	E^+ of penis and scrotum with E extending into groin	Vesication of peno-scrotal junction.	Vesicles broken, crusting of scrotum.	Scrotum oozing with moist desquamation. Penis shows moist desquamation.
3.	E^+ of penis and scrotum extending to E^- of the groins and inner side of the thighs.	E^+ of penis and scrotum accentuated E^- fading on thighs	E^+ subsiding. Cracking of scrotum with marked oozing of peno-scrotal junction.	V at root of penis, moist desquamation of scrotum and crusting.
4.	E^+ of penis and scrotum extending to E^- inner side of thighs.	E^+ of penis and scrotum accentuated. V of scrotum.	Marked edema of prepuce with oozing of penis and scrotum.	Massive edema of prepuce and scrotum with extensiv moist desquamation.
5.	E^+ of penis and scrotum, edema marked on both areas.	Massive edema of penis and scrotum. E^+ of inner sides of thighs.	Vesication of scrotum. PPV of inner sides of thighs.	Moist desquamation and secondary infection of penis and scrotum.
6.	E^- of scrotum	E^+ of scrotum	Small area of moist desquamation on scrotum	Scrotum desquamating.
7.	E^+ of prepuce and scrotum	Small areas of PPV developed.	Oozing and crusting of scrotum most marked at peno-scrotal junction.	Moist desquamation of prepuce and scrotum.
8.	E^+ of penis and scrotum	E of penis and scrotum with soreness	Scrotum crusted and improving.	Moist desquamation of scrotum.
9.	E of penis and scrotum	No change	Scrotum oozing	Moist desquamation of scrotum.
10.	E^+ of penis and scrotum	Increased tenderness	Edema subsiding. Scrotum oozing and cracked	Moist desquamation of penis and scrotum.

Observers 1 to 5 hospitalized 72 hours after exposure.